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GEOCHEMISTRY OF AMPHIBOLITES FROM THE KOLAR SCHIST BELT;

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Amphibolites are the predominant rock type of the Kolar Schist Belt. Because the amphibolites are interbedded with ferruginous cherts and graphitic schists and show rare pillow structures, it is thought that they originally formed in a submarine environment. The amphibolites are komatiitic and tholeiitic in composition. The komatiitic amphibolites are relatively minor and occur as thin, folded units interbedded with the tholeiitic amphibolites near the eastern and western margins of the belt. In the central part of the belt is a fine-grained, massive, tholeiitic amphibolite, which divides the belt into western and eastern parts. The komatiitic amphibolites to the east have Ce/Nd ratios graeter than that of chondrites, while those to the west have Ce/Nd ratios less than that of chondrites (Fig. 1). Rajamani et al. (1,2) suggest: that the komatiitic amphibolites are derived by relatively low percentages of melting (less than about 20%) of a mantle source with a somewhat higher Mg/Fe ratio than pyrolite at pressures of about 50 Kb; and that the tholeiitic amphibolites are not simply related to the komatiites, but are derived from a source with a much greater Fe/Mg ratio than that of the komatiites at pressures less than about 25 Kb.

The komatiitic amphibolites from the western side of the belt have a wide range in Sm/Nd ratios, which we interpret as reflecting varying proportions of garnet left in a residue as a result of different extents of melting (Fig. 2). The Sm/Nd age for the western komatiitic amphibolites is 2690$\pm$140 Ma with epsilon Nd values ranging from +2 to +8. No known rock can act as a contaminant to produce these high, positive epsilon values. Thus, we suggest that the sources of these rocks were (variably?) depleted in light REE for a significant period of time. We have to wonder whether these western komatiitic amphibolites may be Archean representatives of modern mid-ocean ridge basalts. The eastern komatiitic amphibolites have a restricted range in Sm/Nd so that no age is calculable. They have an epsilon Nd of +2 to +7 at 2690 Ma.

The eastern komatiites, western komatiites and western tholeiites all have quite different U-Pb histories (Fig. 3). The scatter in the Pb isotope whole-rock data for each of the types of amphibolites suggests that the amphibolites may have been contaminated by extraneous Pb, perhaps from the surrounding gneisses. The Pb data from one outcrop of the central massive tholeiitic amphibolite give a Pb-Pb isochron age of 2733$\pm$155 Ma, which is consistent with the Sm/Nd isochron age for the western komatiites. Surprisingly, the Pb data for the komatiites and tholeiites are quite different, suggesting the interlayered komatiites and tholeiites have separate sources. Less surprisingly, the eastern komatiitic amphibolites have Pb isotope characteristics quite different from those of either the western komatiites or western tholeiites. Too few eastern tholeiitic amphibolites have been analyzed to determine whether they also have separate sources.

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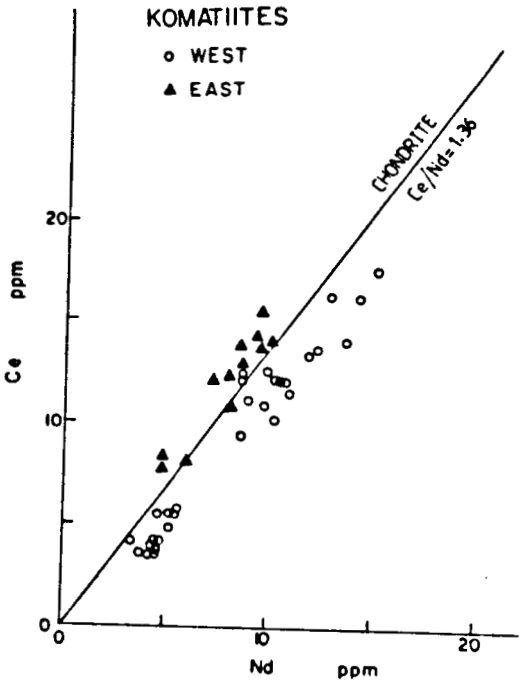

Fig. 1. Ce versus Nd concentrations of the western and eastern komatiitic amphibolites compared to a line with a chondritic Ce/Nd ratio. Essentially all of the western komatiites have a Ce/Nd ratio less than that of chondrites, whereas the eastern komatiites have a Ce/Nd ratio greater than that of chondrites. This consistent difference in ratio over a large range in composition implies that the mantle sources for the two komatiitic suites had the same Ce/Nd characteristics as the amphibolites (3).

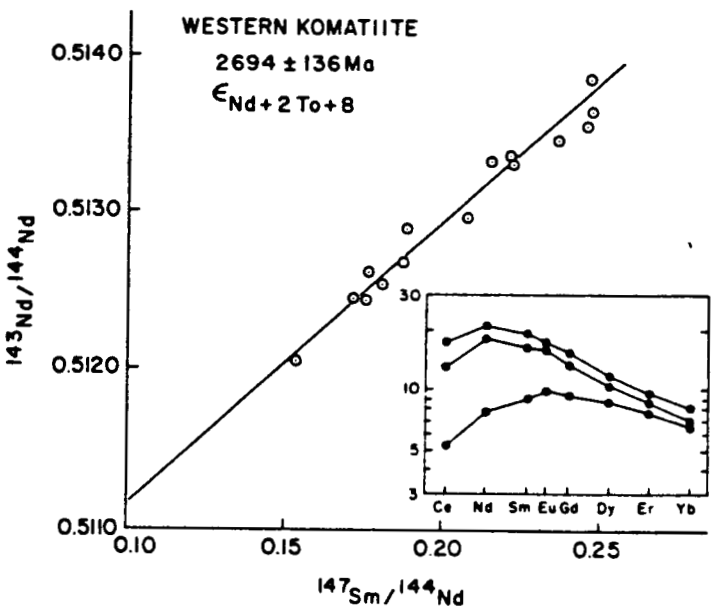

Fig. 2. Sm/Nd isochron diagram for samples of the western komatiites. The inset shows REE patterns for representative samples of this suite. The spread in Sm/Nd ratios is most probably due to varying extents of melting of a mantle source leaving varying fractions of garnet in the residue. The Sm/Nd isochron would thus be dating the time of melting. The positive epsilon values and scatter of data suggest a source for the western komatiitic amphibolites with a long-lived history of variable, light REE depletion.

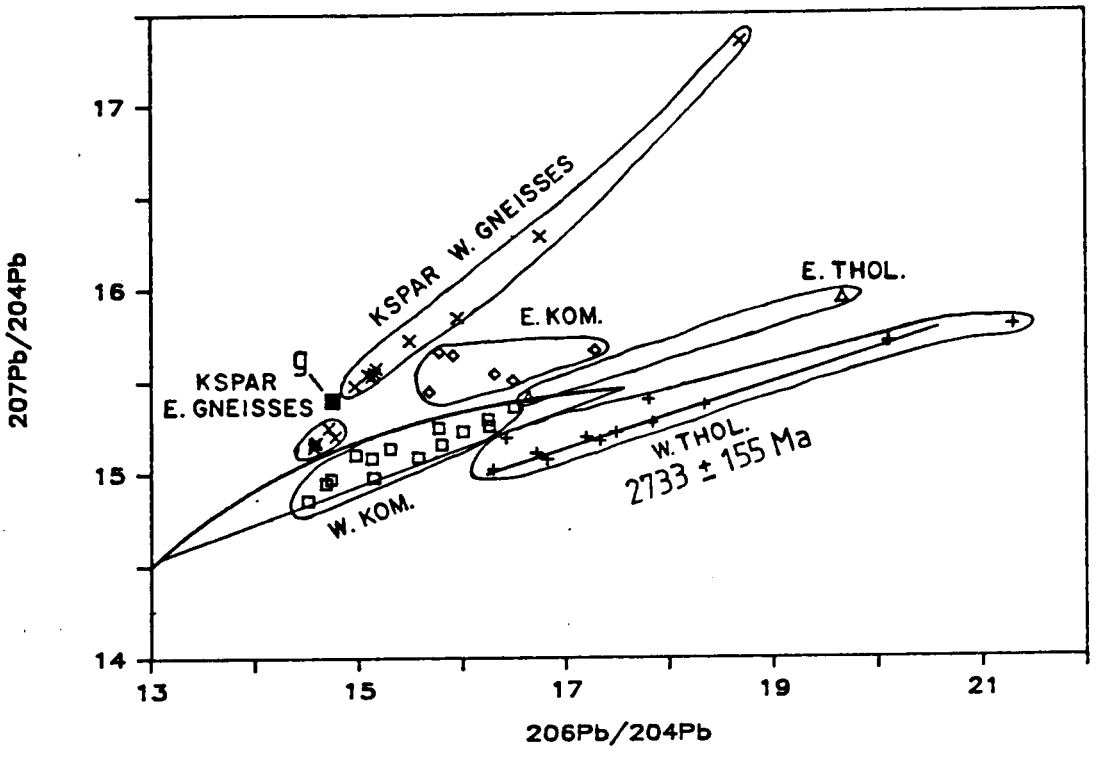

Fig. 3. Pb isotope data for the eastern and western komatiitic and tholeiitic amphibolites compared to the Pb isotope data for leached potassium feldspars from the gneisses east and west of the belt (4) and galena from within the belt (5). Whereas the Pb data for the western tholeiitic amphibolites from a number of outcrops show a scatter, the data for samples from one outcrop lie closely about a line and give an age of 2733±155 Ma. The Pb isotope data for the eastern and western komatiites show considerable scatter, suggesting that they may have been contaminated by extraneous Pb, perhaps represented by the galena which has a composition similar to that of some of the western gneisses.

1. Rajamani et al., 1985, J. Petrology, 26, 92-123.
2. Rajamani et al., in prep.
3. Sun and Hanson, 1975, Contrib. Mineral. Petrol. 52, 77-106.
4. Krogstad et al., this volume.
5. Chernyshev et al., 1980, J. Geol. Soc. India, 21, 107-116.